

**Selected Instruments
and Related Products****1986**U.S. Department of Commerce
BUREAU OF THE CENSUSMA38B(86)-1
Issued November 1987**SUMMARY OF FINDINGS**

During 1986, manufacturers' value of shipments of selected instruments and related products totaled \$24,798.9 million, an increase of less than 1 percent over the 1985 value of shipments. This figure includes automatic regulating and control valves \$1,325.8 million, an increase of less than 1 percent over 1985; aeronautical, nautical, and navigational instruments, \$1,931.9 million, an increase of 21 percent over 1985; controls for monitoring residential and commercial environments and ap-

pliance regulating controls, \$2,027.3 million, an increase of 5 percent over 1985; process control instrumentation, \$3,891.0 million, a decrease of 2 percent over 1985; test equipment for testing electrical, radio, and communication circuits and motors, \$5,270.3 million, a decrease of 8 percent over 1985; and analytical and scientific instruments, \$2,724.6 million, an increase of 1 percent over 1985.

A description of the survey methodology and related information appear on page 18.

Table 1. VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS, BY CLASS OF PRODUCT: 1977 TO 1986
(Millions of dollars)

Product code	Product description	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977
34947	Automatic regulating and control valves.....	1,325.8	1,324.3	1,190.4	1,146.5	1,184.5	1,147.0	1,081.7	918.0	819.9	703.3
34948	Solenoid valves (except power transfer).....	281.1	280.1	266.6	202.6	201.5	182.7	178.3	166.8	155.0	138.0
38111	Aeronautical, nautical, and navigational instruments.....	1,931.9	1,592.0	1,466.9	1,428.6	1,404.7	1,326.6	1,069.3	945.3	745.9	775.3
38112	Laboratory and scientific apparatus.....	1,126.4	1,138.1	1,101.1	976.2	1,028.1	899.6	840.9	705.1	688.0	611.8
38113	Surveying and drafting instruments.....	390.9	379.5	326.5	246.2	256.2	270.3	279.5	235.4	220.5	164.3
38220	Controls for monitoring residential and commercial environments and appliance regulating controls.....	2,027.3	1,925.6	1,943.3	1,678.8	1,639.4	1,472.9	1,417.0	1,261.0	1,157.8	1,125.3
38236	Process control instruments.....	3,891.0	3,963.2	3,803.4	3,289.9	3,750.8	3,423.2	3,030.3	2,635.9	2,072.2	1,906.1
38242	Integrating and totalizing meters for gas and liquids.....	520.1	548.6	493.4	449.4	493.5	565.1	600.1	450.8	366.6	334.3
38243	Counting devices.....	175.2	174.9	209.4	172.9	166.7	193.2	192.1	167.1	176.9	141.3
38244	Motor vehicle instruments*.....	203.6	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
38251	Integrating instruments, electrical.....	403.0	402.6	418.4	356.0	339.0	303.7	297.4	284.9	241.0	216.0
38252	Test equipment for testing electrical, radio, and communication circuits, and motors.....	5,270.3	5,698.9	5,919.3	4,878.7	4,384.4	3,854.6	3,295.5	2,847.4	2,242.0	1,706.0
38253	Instruments to measure electricity.....	606.4	603.0	642.5	540.8	539.0	567.7	514.4	497.8	457.4	399.8
38291	Aircraft engine instruments.....	504.7	393.1	337.5	335.2	290.3	275.1	258.9	196.8	159.6	115.1
38292	Physical properties and kinematic testing equipment.....	730.4	660.8	651.9	564.4	590.7	509.4	477.9	392.3	304.9	276.4
38293	Commercial, geophysical, meteorological, and general purpose instruments.....	319.3	354.4	380.5	293.9	325.4	228.4	238.9	223.1	190.1	195.3
38294	Nuclear radiation detection and monitoring instruments.....	560.6	542.2	494.9	503.4	561.5	453.2	388.9	423.7	424.7	350.7
38326	Analytical and scientific instruments.....	2,724.6	2,716.0	2,748.7	2,438.6	1,990.3	1,740.0	1,518.2	1,284.4	1,110.6	872.6
38325	Optical instruments and lenses.....	1,219.2	1,345.8	1,442.9	1,059.9	893.7	871.9	797.0	615.9	482.0	373.1
38324	Sighting, tracking, and fire-control equipment, optical type.....	566.9	556.3	562.0	479.2	492.2	324.4	310.4	266.3	204.2	208.0

* New for 1986. (NA) Not available.

Address inquiries concerning these figures to U.S. Department of Commerce, Bureau of the Census, Industry Division, Washington, D.C. 20233, or call Deborah Dillon, (301) 763-5194.

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Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
34947	Automatic valves (regulating and control type, except nuclear).....	139	(X)	1,325,773	(X)	1,324,253
	Engineered specification valves, designed to perform a precise degree of continuous modulation of controlled variables as the final element of a sophisticated instrumentation loop (commonly referred to as control valves and including certain globe, butterfly, ball, diaphragm, and similar body types):					
	Pneumatic actuated:.....	(X)	(X)	482,779	(X)	483,881
	Sliding stem valves.....	(X)	685,414	215,826	775,099	214,690
34947 01	Globe body.....	28	^a 642,866	176,559	^c 723,741	^c 172,283
34947 02	All other types.....	18	42,548	39,267	^c 51,358	^c 42,407
34947 03	Rotary valves.....	(X)	3,470,842	110,694	3,440,837	114,868
34947 04	Ball.....	11				
34947 05	Butterfly.....	13	3,462,224	103,124	^c 3,430,487	^c 105,845
34947 06	Plug.....	1				
34947 07	All other rotary valves (including eccentric disk).....	7	8,618	7,570	^c 10,350	^c 9,023
34947 08	All other pneumatic power-operated control valves.....	24	^c 430,052	68,258	431,415	77,355
34947 09	Parts for pneumatic actuated valves (sold separately).....	29	(X)	88,001	(X)	76,968
	All other actuation, including electric-actuated and electro-hydraulic actuated:.....	(X)	(X)	190,803	(X)	173,441
	Sliding stem valves.....	(X)	87,780	18,810	79,542	21,182
34947 11	Globe body.....	10	3,294	7,195	^c 3,392	^c 9,122
34947 12	All other types.....	12	^a 84,486	11,615	^c 76,150	^c 12,060
34947 13	Rotary valves.....	(X)	16,207	11,299	^c 15,041	^c 8,297
34947 14	Ball.....	4	2,598	6,173	1,905	3,926
34947 15	Butterfly.....	6				
34947 16	Plug.....	3	13,609	5,126	13,136	^c 4,311
34947 17	All other rotary valves (including eccentric disk).....	2				
34947 18	All other power-operated (except pneumatic) control valves.....	31	6,980,499	150,619	^c 5,805,905	^c 131,662
34947 21	Parts for all other power-operated (except pneumatic) control valves.....	19	(X)	10,075	(X)	12,300
34947 23	Valve actuators (sold separately).....	22	192,641	62,113	^c 180,739	^c 69,812
	Regulator valves equipped with self-generating power actuator acting in response and in proportion to a change in value of the controlled variable, such as temperature, pressure, flow level, etc.):					
34947 25	Remote-sensing direct actuated temperature regulators... Self-contained direct actuated pressure regulators (except instrument type and safety relief valves).....	21	1,701,132	46,269	^c 1,594,064	46,647
34947 30	Pilot (internal and external) actuated pressure regulators.....	37	11,491,548	164,233	10,997,843	170,678
34947 35	Self-contained direct acting precision and instrument type pneumatic (air and gas) pressure regulators.....	34	204,369	37,731	200,486	36,814
34947 41	Flow regulators for gas, vapors, or liquids.....	11	343,740	20,180	322,994	22,055
34947 45	Other regulator valves.....	34	^b 9,012,752	^a 179,497	^c 9,720,710	^c 179,413
34947 48	Parts for regulator valves (sold separately).....	38	3,075,562	110,729	^c 3,307,958	^c 116,741
34947 49	Parts for regulator valves (sold separately).....	32	(X)	31,439	(X)	24,771
34948	Solenoid valves (except nuclear).....	48	(X)	281,129	(X)	280,126
	Solenoid valves of the type actuated by the movement of a plunger or armature due to the magnetic field created by electrically energizing a solenoid coil (excluding torque motor rotary type actuated valves and servo-valves and fluid power hydraulic and pneumatic solenoid valves):					
	Solenoid valves, except power transfer valves:					
	Commercial/Industrial types:					
34948 56	Two-way.....	35	3,878,217	138,874	4,093,618	^c 150,149
34948 58	Three-way.....	20	706,153	22,149	^c 736,690	22,642
34948 59	Other.....	18				
34948 61	Household appliance type.....	2	9,124,832	94,239	^c 6,550,337	^c 79,821
34948 79	Parts, components, and operators for solenoid valves, except power transfer valves (sold separately).....	17	(X)	24,867	(X)	27,514
38111	Aeronautical, nautical, and navigational instruments, except aircraft engine instruments.....	95	(X)	1,931,913	(X)	1,592,026
	Flight and navigation sensors, transmitters, and displays:					
38111 01	Compasses (magnetic and gyroscopic).....	18	(X)	78,362	(X)	75,683
38111 03	Radio navigation receivers and displays (including omni, radio magnetic, glide slope/localizer, DME, etc.).....	13	(X)	67,838	(X)	40,414
38111 08	Altimeters (except radio and radar altimeters).....	13	(X)	27,310	(X)	^c 35,947
38111 10	Airspeed indicators (including machmeters and air data computers).....	19	(X)	231,083	(X)	^c 184,860
38111 12	Acceleration indicators and systems components.....	8	(D)	(D)	(D)	(D)
38111 13	Rate-of-climb indicators.....	10	^b 26,766	^a 15,024	^b 21,575	^a 13,453
38111 15	Angle-of-attack indicators.....	7	3,539	11,404	^c 4,430	18,049
38111 17	Bank and turn indicators.....	3	(D)	(D)	(D)	(D)
38111 22	Artificial horizon flight instruments.....	10	^b 25,358	109,892	^b 26,547	^c 107,092
38111 20	Other aerospace and navigational instruments.....	27	(X)	430,024	(X)	^c 349,703
	Gyroscopes sold separately:					
38111 21	Vertical.....	6	^a 7,904	24,386	4,761	18,826
38111 23	Directional.....	9	31,607	73,314	^c 5,530	53,054
38111 25	Free, torqued and untorqued.....	2	(X)	116,863	(X)	86,753
38111 26	Rate, inertial grade.....	3				
38111 28	Rate, noninertial grade.....	5	(X)	96,869	(X)	84,938

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
38111 61	Airframe equipment instruments: Position indicators (mechanical, as for landing gear, cowl flaps, stabilizers, etc.).....	9	(X)	9,906	(X)	8,965
38111 63	Hydraulic system (both electrical and mechanical measuring means, as for liquid level and temperature and pressure indicators).....	11	(X)	32,358	(X)	27,011
38111 64	Cabin environmental measuring and control instrument (air-conditioning and heating, cabin pressure, oxygen, etc.).....	12	(X)	23,458	(X)	23,743
38111 77	Thermocouple and thermocouple lead wire (aircraft type only).....	4	(X)	3,963	(X)	2,565
38111 80	Other aerospace flight instruments.....	26	(X)	361,989	(X)	303,520
38111 85	Nautical instruments (all types, including temperature, speed, pitch, and roll instruments and system components, etc.).....	20	^a 610,022	81,966	^a 686,868	90,214
38111 89	Parts and components for aeronautical, nautical, and navigational instruments, except aircraft engine instruments, (sold separately).....	9	(X)	12,279	(X)	13,239
38112	Laboratory and scientific apparatus.....	136	(X)	1,126,357	(X)	1,138,089
38112 20	Laboratory balances and scales: Sensitivity of 5 centigrams or better.....	13	988,447	^a 54,905	^a 953,385	^a 57,018
38112 22	Sensitivity of less than 5 centigrams.....	10				
38112 23	Laboratory furnaces and ovens.....	23	(X)	30,705	(X)	25,842
38112 24	Laboratory centrifuges: Table-top type.....	11	22,480	34,139	^c 24,093	39,838
38112 26	Floor type: Refrigerated.....	3	10,516	88,914	14,766	102,458
38112 30	Other.....	3				
38112 27	Laboratory evaporation and distillation apparatus.....	15	(X)	10,785	(X)	8,376
38112 28	Laboratory sterilizers and autoclaves.....	10	(X)	17,520	(X)	18,372
38112 29	Laboratory burners and hot plates.....	10	(X)	10,389	(X)	10,693
38112 31	Laboratory granulators, mills, and other particle size reduction apparatus.....	8	(X)	2,084	(X)	2,371
38112 33	Laboratory dryers.....	8	(X)	2,178	(X)	2,038
38112 35	Laboratory blenders, mixers, shakers, dispensers, fraction collectors, and other liquid sample preparation apparatus.....	29	(X)	55,265	(X)	39,613
38112 36	Laboratory incubators.....	10	5,910	30,311	^c 6,008	29,276
38112 38	Laboratory freezers.....	9	7,278	25,257	12,762	24,259
38112 42	Microtomes.....	1	(X)	-	-	-
38112 48	All other laboratory and scientific apparatus not specified above (including wet and dry baths, melting point apparatus, etc., excluding analytical instruments). Components, parts and accessories for laboratory and scientific apparatus (sold separately).....	87	(X)	432,877	(X)	456,190
38112 99	Components, parts and accessories for laboratory and scientific apparatus (sold separately).....	49	(X)	331,028	(X)	321,745
38113	Surveying and drafting instruments and associated equipment and laboratory furniture.....	51	(X)	390,910	(X)	379,450
38113 11	Surveying instruments, including alidades, transits, plumb bobs, sextants, theodolites, surveyors, compasses, surveyors levels, tapes, etc.....	14	(X)	84,107	(X)	75,814
38113 19	Parts and components for surveying instruments (sold separately).....	1				
38113 21	Drafting instruments and machines, manual and automatic, plotting instruments, slide rules, T-squares, drafting templates, rules, etc.....	18	(X)	119,853	(X)	114,790
38113 29	Parts and components for drafting instruments and machines (sold separately).....	3	(X)	17,379	(X)	17,994
38113 31	Photogrammetric and geodetic equipment, excluding cameras. Parts and components for photogrammetric and geodetic equipment (sold separately).....	1				
38113 41	Laboratory furniture, including cabinets, cases, benches, tables, stools, and reagent shelves, etc.....	16	(X)	169,571	(X)	170,852
38113 49	Parts and components for laboratory furniture (sold separately).....	-	(X)	-	(X)	-
38220	Controls for monitoring residential and commercial environments and appliance regulating controls.....	77	(X)	2,027,254	(X)	1,925,610
38220 21	Automatic controls of the type principally used as components of air conditioning, refrigeration, and comfort heating (including pneumatic controls): Temperature responsive (thermostats): Electric.....	33	38,507,654	334,117	44,966,138	320,007
38220 22	Pneumatic.....	9	18,993,014	155,286	23,586,602	166,114
38220 23	Pressure responsive (pressuristats).....	9	18,678,274	62,778	19,752,753	61,341
38220 30	Hydronic responsive.....	5	2,325,641	38,929	2,505,227	33,402
38220 35	Humidity responsive (humidistats).....	3				
38220 40	Light responsive.....	-	-	-	-	-
38220 45	Electrostatic responsive.....	-	-	-	-	-
38220 50	Liquid level.....	2	1,061,197	2,490	1,087,245	3,309
38220 55	Defrost controls (except appliance regulators).....	2	-	-	-	-

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
38220	Controls for monitoring residential and commercial environments, etc.--Continued					
	Automatic controls of the type principally used as components of air conditioning, refrigeration, and comfort heating (including pneumatic controls)--Cont. Temperature responsive (thermostats)--Continued	7	88,332,913	141,712	74,383,355	109,612
38220 60	Igniters.....	4				
38220 65	Inherent motor protectors.....		319,258	16,911	426,105	20,458
38220 66	Microprocessor-based load programmers for buildings energy control.....	6				
	Computerized energy control systems for buildings:	2	(X)	444,491	(X)	369,833
38220 67	Under 100 points (systems).....	1				
38220 68	100 to 199 points (systems).....	3				
38220 69	200 or more points.....		(X)	143,122	(X)	143,162
38220 71	Upgrades or additions to existing computerized energy control systems for buildings (value only).....	1				
38220 74	Other.....	11	17,668,003		19,328,079	
	Controls for major appliances such as domestic laundry and cooking appliances, refrigerators and freezers, vending machines, air conditioners, etc.:	18	109,212,080	252,003	107,192,833	249,981
38220 75	Temperature responsive.....	1	43,178,306	231,827	40,331,159	223,192
38220 77	Hydraulic and pneumatic.....	1				
38220 78	Pressure responsive.....	8				
38220 81	All other controls for appliances.....					
38220 98	Parts and components for controls for monitoring residential and commercial environments and appliance regulating controls (sold separately).....	15	(X)	205,588	(X)	225,199
38230	Process control instruments.....	376	(X)	3,891,019	(X)	3,963,213
	Industrial type instruments and related products primarily designed to measure, transmit, display, and/or control process variables in manufacturing, mining, energy conversion and public utilities. General purpose control system instruments (commonly called receiver-type), operating from standardized transmission signals (electrical types a.c. or d.c. milliamperes, millivolt, or telemetering signals):					
	Pneumatic types, 3 to 15 and 3 to 27 p.s.i. signals:					
	Electronic systems - unified architecture type:	32	178,864	105,054	208,184	91,990
38230 33	Controllers (recording, indicating, or blind).....					
38230 36	Recorders, with or without self-contained set-point stations.....	26	49,757	67,183	56,828	76,938
38230 37	Indicators, with or without self-contained set-point stations.....	25	66,383	35,103	75,474	40,686
38230 38	Auxiliary stations and analog computing devices associated with the above (including manual loaders, auto-to-manual stations, ratio stations, adders, multipliers, integrators, etc.).....	15	29,556	15,399	32,682	17,064
38230 07	Electronic systems - non-unified architecture type.....	32	(X)	685,050	(X)	705,580
38230 12	Industrial multi-function process computers.....	39	(X)	144,453	(X)	135,415
	Pneumatic systems:					
	Includes all system-type control, display and computing instruments actuated from standardized pneumatic transmission signals:	16	58,434	39,505	76,559	44,199
38230 39	Controllers (recording, indicating, or blind).....					
38230 40	Recorders, with or without self-contained set-point stations.....	9	4,130	6,392	4,754	7,064
38230 41	Indicators, with or without self-contained set-point stations.....	5	1,370	1,043	1,710	1,038
38230 42	Auxiliary stations and analog computing devices associated with the above (including manual loaders, auto-to-manual stations, ratio stations, adders, multipliers, integrators, etc.).....	6	23,768	7,624	23,680	7,019
38230 43	Receiver-type gauges, analog and digital.....	16	661,021	13,836	702,471	14,039
38230 44	Annunciators, industrial; electromechanical and solid-state types.....	8	22,607	38,471	23,668	36,734
	Temperature instruments (excluding receiver-type instruments):					
	Electrical and electronic measuring types (thermo-coupler resistance temperature detector, radiation, and other electrical sensors):					
38230 45	Direct-deflecting types (controllers for all types of electrical temperature sensors).....	7	138,492	17,386	200,471	18,628
38230 46	Direct-deflecting types (indicators and recorders for all types of electrical temperature sensors).....	12				
38230 47	Electromechanical self-balancing types (electric or pneumatic controllers for all types of electrical temperature sensors).....	5	47,090	14,112	48,946	15,383
38230 48	Electromechanical self-balancing types (indicators, recorders, and integrators for all types of electrical temperature sensors).....	7	28,269	29,027	25,863	36,171
38230 49	Electronic controllers for all types of electrical temperature sensors.....	29	247,939	55,185	262,948	58,838

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued
(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
	Temperature instruments (excluding receiver-type instruments):--Continued					
	Electrical and electronic measuring types (thermocouple resistance temperature detector, radiation, and other electrical sensors):--Continued					
38230 50	Digital indicators for all types of electrical temperature sensors (excluding data loggers).....	28	61,132	32,299	77,607	36,904
	Transmitters, producing standardized electric or pneumatic analog transmission signals for all types of electrical temperature sensors:					
38230 54	Electric.....	16	70,038	21,561	71,877	22,579
38230 55	Pneumatic.....	5	1,083	756	1,285	938
	Mechanical measuring types, filled systems (liquid filled, vapor pressure, gas filled, and mercury filled types):					
38230 52	Indicating or recording controllers.....	13	160,058	18,303	192,573	20,863
38230 53	Recorders, noncontrol.....	17	52,552	6,060	465,611	8,084
38230 56	Indicators only (excluding indoor-outdoor and other household or appliance type thermometers).....	19	1,119,607	27,191	1,195,705	28,971
38230 57	Transmitters producing standardized electric or pneumatic analog transmission signals.....	9	25,959	11,923	24,155	12,571
	Primary temperature sensors (excluding aircraft types):					
38230 59	Thermocouples and thermocouple lead wire.....	46	(X)	144,797	(X)	127,384
38230 60	All other types (resistance temperature detectors, radiation and optical sensors, thermistors, etc.).....	35	(X)	48,524	(X)	61,448
	Pressure (gauge, absolute vacuum) and draft instruments connected to the process (excluding receiver-type instruments and receiver-type gauges):					
38230 61	Indicating or recording controllers.....	22	240,744	31,481	232,804	32,124
38230 62	Recorders, noncontrol.....	13	4,055	2,808	4,011	3,265
	Indicators only (excluding receiver-type gauges):					
38230 20	3-inch diameter and over.....	23	2,944,431	88,341	3,332,015	102,640
38230 21	Under 3-inch diameter.....	14	19,255,016	54,018	21,440,803	56,028
	Transmitters producing standardized analog transmission signals:					
38230 24	Transmitters producing standardized electronic analog transmission signals.....	30	1,637,961	126,913	1,070,332	123,493
38230 25	Transmitters producing standardized pneumatic analog transmission signals.....	10	8,661	6,383	11,679	9,554
	Flow and liquid level instruments connected to the process:					
	Differential pressure types:					
38230 65	Indicating or recording controllers.....	15	44,668	15,729	48,365	15,245
38230 66	Recorders, noncontrol and indicators, noncontrol.....	21	94,461	48,807	126,470	59,409
	Transmitters producing standardized analog transmission signals:					
38230 27	Transmitters producing standardized electronic analog transmission signals.....	19	111,419	100,995	110,928	101,917
38230 28	Transmitters producing standardized pneumatic analog transmission signals.....	9	13,393	15,504	17,399	19,455
38230 29	Primary pressure sensors (load cells, strain gauges, etc.).....	9	85,813	42,182	70,413	34,747
38230 68	Primary flow elements (including orifice plates, venturi tubes, flow tubes, flow nozzles, pitot tubes, etc.).....	23	272,648	44,316	304,478	49,139
	Electromagnetic flowmeters:					
38230 03	Primary device (magnetic flow tube).....	6	62,287	35,223	72,680	41,696
38230 01	Secondary device (magnetic transmitter, recorder, indicator or controller which receives signal directly from primary device).....	16	80,866	46,400	85,865	47,365
38230 04	Capacitance, ultrasonic, and other electronic types (including magnetic resonance, vortex-precession, and vortex-shedding type elements).....	17	40,720	27,554	37,953	27,440
38230 71	Variable area-controlling, recording, indicating, and transmitting instruments and associated primary flow elements.....	15	805,222	68,498	781,630	70,068
38230 72	Float and displacement (controlling, recording, indicating, and transmitting instruments and associated primary flow elements).....	22	1,182,923	46,402	1,428,479	62,585
38230 73	Turbine, mass-flow and other types (controlling, recording, indicating, and transmitting instruments and associated primary flow elements).....	23	149,513	91,123	218,888	94,889
38230 74	Humidity instruments (controlling, recording, indicating, and transmitting, and associated primary humidity elements; excluding home and general purpose type).....	14	56,173	18,484	60,199	19,110

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
	Process control instruments--Continued					
	Continuous process instruments for on-stream gas and liquid analysis (including indicators, recorders, controllers, and analysis electrodes and cells; excluding laboratory analysis types):					
38230 75	Chromatographic analyzers.....	10	4,319	46,397	4,433	46,714
38230 76	Infrared analyzers.....	12	8,674	30,023	10,526	45,102
38230 77	Oxygen analyzers.....	17	12,171	26,572	10,353	23,956
38230 78	Other gas analyzers.....	29	25,089	55,080	38,157	62,807
38230 79	Ph analyzers.....	8	50,518	23,180	53,226	22,746
38230 80	Other liquid analyzers.....	27	69,812	57,062	75,092	71,878
	Instruments for all process variables not listed above (speed, weight, position, sequence, density, specific gravity, mechanical load, electrical load, millivolts):					
	Electrical and electronic types:					
38230 06	Direct-deflecting type controllers, indicators and recorders.....	6	12,918	9,891	15,999	10,967
38230 08	Electromechanical self-balance electric or pneumatic controllers, indicators, recorders, integrators....	7	15,259	13,406	19,123	23,823
38230 85	Digital indicators.....	10	6,512	14,121	9,727	13,390
38230 86	Transmitters producing standardized electric or pneumatic analog transmission signals.....	8	1,762	3,203	1,478	2,080
	Mechanical measuring types:					
38230 87	Indicating or recording controllers.....	8	10,514	9,094	11,831	9,495
38230 88	Recorders, noncontrol.....	5				
38230 89	Indicators only.....	3				
38230 90	Transmitter, producing standardized electric or pneumatic analog transmission signals.....	13	242,678	49,044	329,318	56,743
	All other industrial process instruments:					
38230 91	Other temperature instruments.....	30	(X)	173,652	(X)	95,867
38230 92	Other flow and liquid level instruments.....	10	(X)	57,607	(X)	59,018
38230 93	Other continuous process instruments.....	15	(X)	70,432	(X)	68,609
38230 94	Other industrial type instruments.....	55	(X)	411,196	(X)	398,137
	Parts, supplies, accessories, other primary sensors, n.e.c. panelboards, and other equipment associated with process control instrumentation:					
38230 95	Primarily designed for temperature instruments.....	5	(X)	96,214	(X)	64,216
38230 96	Primarily designed for flow and liquid level instruments	15	(X)	28,046	(X)	39,402
38230 97	Primarily designed for continuous process instruments....	17	(X)	149,854	(X)	169,840
38230 99	Primarily designed for industrial type instruments.....	26	(X)	69,147	(X)	81,725
38242	Integrating and totalizing meters for gas and liquids.....	37	(X)	520,111	(X)	548,571
	Gas meters, consumption registering:					
	Diaphragm type: Positive displacements; aluminum, iron, and tin case:					
38242 22	Residential size (up to 400 cu. ft./hr. of 0.64 specific gravity gas, at 0.5 inches water drop).....	4	2,163,161	91,866	1,963,630	81,704
38242 24	Other sizes, including commercial and industrial.....	5	105,333	33,622	104,325	36,545
38242 26	Rotary type (all sizes).....	4	28,932	38,827	28,481	41,639
38242 28	Turbine type (all sizes).....	4				
38242 29	Other gas meters, consumption registering.....	-	-	-	-	-
	Liquid meters, positive displacement with registers and counters:					
	Water meters, consumption registering:					
38242 33	Small meters, up to and including 1 inch.....	10	3,393,088	107,895	3,406,146	106,048
38242 35	Intermediate meters, over 1 inch up to and including 2 inch.....	13	116,178	28,286	107,134	26,542
38242 37	Large meters, over 2 inch.....	8	44,884	39,984	58,702	52,353
38242 41	Liquid fuel dispensing meters (excluding service station dispensing pumps).....	9	242,909	42,844	249,369	48,780
38242 98	Other liquid meters; industrial bulk plants, pipeline, batching, treatment facilities.....	13	193,929	72,625	197,516	92,976
38242 99	Parts and components for gas and liquid meters (sold separately).....	20	(X)	64,162	(X)	61,984
38243	Counting devices (excluding motor vehicle instruments).....	50	(X)	175,205	(X)	174,894
38243 30	Tachometers, including speed indicators.....	1	2,091,774	19,526	3,386,910	24,458
	Other:					
38243 21	Mechanical input.....	14				
38243 23	Electrical input.....	15				
38243 25	Electronic input.....	23				
38243 27	Pneumatic input.....	2	371,367	52,745	327,290	30,919
38243 29	Other counters, including event recorders.....	2	6,006	2,114	6,534	2,609
38243 76	Taximeters.....	4				
38243 82	Parking meters, including parts and components sold separately.....	2	(X)	62,492	(X)	52,240
38243 85	All other counting devices not specified above, including toll meters etc., but excluding parking meters.....	5	(X)	62,492	(X)	52,240
38243 88	Components and parts for counting devices, except parking meters (sold separately).....	9	(X)	5,196	(X)	5,405

See footnotes at end of table.

SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued

of units; value in thousands of dollars)

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF S

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF S		Number of companies	1986		1985	
Product code	Product description (Quantity in number)		Quantity	Value	Quantity	Value
	rs are	19	(X)	203,583		
38244	Motor vehicle instruments*.....are	9	15,262,566	147,897	(NA)	(NA)
38244 11	Speedometers (speedometers including odometers classified as speedometers).....	10				
38244 21	Tachometers.....	2	251,622	3,947		
38244 31	Odometers (speedometers including odometers classified as speedometers).....	4				
38244 41	Fuel level gauges.....	4	740,933	5,218		
38244 45	Water temperature gauges.....	4				
38244 51	Ammeters.....	14	(X)	46,521		
38244 55	Oil pressure gauges.....	22	(X)	403,039	(X)	402,574
38244 99	Other motor vehicle instruments.....					
38251	Electrical integrating instruments.....	6	3,871,732	120,398	4,178,272	126,372
	A.c. watt-hour meters:	1				
	Single phase:	2				
	Detachable types.....our and demand	7	492,543	65,695	552,338	70,743
38251 10	A-base types.....combined watt-					
38251 11	Switchboard types.....ing d.c. watt-	9	415,826	103,384	369,094	94,359
38251 15	Polyphase.....miscellaneous					
38251 35	Demand meters (kw and kva), combined watt-ho meters (single phase and polyphase), and co	10	(X)	35,074	(X)	39,389
38251 51	Other electrical integrating meters (including hour meters, ampere-hour meters, and other integrating instruments not included in the classifications).....test	10	(X)	78,488	(X)	71,711
38251 61	Parts and accessories for electric integratio (including meter mountings, registers, and equipment) sold separately.....radio and equipment	259	(X)	5,270,344	(X)	5,698,855
38252	Test equipment for testing electrical communication circuits, and motors.....	29	(X)	209,612	(X)	208,381
	Voltage, current, and resistance measuring (except multimeters):	28	(X)	29,759	(X)	41,531
	Electronic:	19	(X)	20,870	(X)	26,082
	Digital.....					
38252 20	Analog.....	19	(X)	108,465	(X)	110,931
38252 21	Electrical (excluding panel meters).....	9	(X)	5,959	(X)	6,542
38252 22	Multimeters:	9	(X)	13,019	(X)	15,474
	Electronic:					
38252 28	Digital.....					
38252 29	Analog.....	20	(X)	40,032	(X)	39,694
38252 30	Electrical.....	16	(X)	34,522	(X)	30,182
	Power and energy measuring equipment: cluding elec-	10	(X)	6,333	(X)	10,312
	Electronic:					
38252 25	Analog.....					
38252 26	Digital.....uency and time					
38252 27	Electrical power measuring equipment (ex- trical integrating instruments, sold sep- asuring	6	(X)	87,191	(X)	99,388
	Frequency counters, timers, and other frequ- measuring equipment (excluding standards): over 1300 MHz).	5	(X)	4,784	(X)	6,334
38252 31	Universal counters with time interval me- capability.....ing equipment...	7	(X)	33,211	(X)	30,853
38252 36	Stroboscopes.....	6				
38252 32	Microwave counters (capable of operating ent:	9				
38252 33	Other frequency counters.....					
38252 34	Frequency meters.....	13				
38252 39	Other frequency counting and time measur.....	8	(X)	440,952	(X)	463,609
	Waveform measuring and/or analyzing equip-.....	6				
	Oscilloscopes and plug-in accessories:	3	(X)	5,022	(X)	4,168
38252 12	Under 10 MHz.....	4				
38252 10	10 MHz up to 99.9 MHz.....	4	(X)	239,558	(X)	275,731
38252 11	100 MHz and over.....	26				
38252 14	Ocillographs.....					
	Spectrum analyzers:					
38252 15	Capable of operating above 100 kHz....	16	(X)	13,058	(X)	12,080
38252 17	Other spectrum analyzers.....	30	(X)	177,290	(X)	181,814
38252 16	Other waveform measuring and analysing eq.....	16	(X)	138,609	(X)	121,447
	Signal generating equipment:					
38252 56	Audio.....quipment (includ-					
38252 58	RF (over 20 kc to 890 megacycles).....	12	(X)	232,710	(X)	248,822
38252 59	Microwave (890 megacycles and above).....	4				
	Field strength and intensity measuring equ- ing RFI measuring equipment):					
38252 91	Electronic.....					
38252 92	Electrical field measuring equipment.....					

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
	Electrical integrating instruments--Continued					
	Impedance and standing wave ratio measuring equipment (transfer function measuring equipment):					
38252 93	Electronic impedance and related measuring equipment....	12	(X)	25,091	(X)	29,790
38252 94	Standing wave measuring equipment (slotted lines, sliding short, reflectometers, and other SWR equipment)	7	(X)	21,343	(X)	13,881
38252 97	X-Y plotters (recorders), electronic.....	8	(X)	33,724	(X)	34,123
	Automatic test and measuring equipment:					
38252 44	Combination and/or group test sets.....	32	(X)	619,258	(X)	610,965
	Component part test sets:					
38252 45	Electron tube test equipment.....	3	(X)	94,068	(X)	111,461
	Semiconductor component test equipment:					
38252 61	Memory.....	8	(X)	158,918	(X)	167,180
38252 63	Linear.....	6	(X)	146,466	(X)	190,915
38252 65	Microprocessor.....	4	(X)	188,527	(X)	182,609
38252 67	Other semiconductor component test equipment.....	22	(X)	170,999	(X)	159,920
38252 69	Circuit board loaded test equipment.....	6	(X)		(X)	
38252 47	Other component part test sets and equipment.....	7	(X)		(X)	
38252 48	Equipment and subassembly test equipment n.e.c.....	23	(X)		(X)	
	Standards and calibration equipment for test measuring equipment, including laboratory types:					
38252 72	Electronic.....	29	(X)	105,460	(X)	134,351
38252 74	Electrical.....	11	(X)	40,960	(X)	49,363
	Analysers for testing characteristics of internal-combustion engines (excluding aircraft):					
38252 37	Portable.....	6	(X)	296,113	(X)	311,620
38252 38	Other.....	9	(X)		(X)	
	Communications test equipment n.e.c.:					
38252 81	Network analyzers.....	6	(X)	75,045	(X)	92,209
38252 83	Cable backplane and other continuity testers.....	3	(X)		(X)	
38252 85	Fiber optics test equipment (OTDR, optical S/N meters, etc.).....	4	(X)		(X)	
38252 87	Other communications test, monitoring, and control equipment (except microwave).....	17	(X)	181,336	(X)	170,264
38252 52	Microwave test equipment n.e.c., (1,300 MHz and above)...	9	(X)	27,588	(X)	34,252
	Logic test, development, and analysis equipment:					
38252 01	Logic analyzers, and similar logic state, timing, and signature analyzers.....	6	(X)	191,089	(X)	217,680
38252 03	Microprocessor development systems.....	2	(X)		(X)	
38252 05	Pulse, function, and data generators and similar metered frequency synthesizers.....	10	(X)	123,766	(X)	119,378
	Other field service test and measurement equipment:					
38252 07	Logic probes, clips, comparators, pulsers, and current tracers.....	4	(X)		(X)	
38252 09	Other field service equipment specifically designed for other troubleshooting digital circuits.....	1	(X)		(X)	
38252 02	Other measuring and checking instruments for testing electrical, radio communications, circuits and motors....	53	(X)	857,596	(X)	1,041,815
	Other analyzing instruments for checking electrical quantities:					
38252 04	With a recording device.....	2	(X)		(X)	
38252 06	Other.....	6	(X)		(X)	
38252 99	Parts and components for test equipment for testing electrical, radio and communication circuits, and motors (sold separately).....	29	(X)	71,741	(X)	93,704
38253	Instruments to measure electricity.....	106	(X)	606,367	(X)	602,974
	Electrical indicating instruments (including both digital types and those where a pointer is made to move over a calibrated scale, such movement being effected by the action of the electrical current and/or voltage):					
	Panel type instruments (includes all aircraft types and all miniaturized instruments + or - 3% and rectifier instruments which can be enclosed in a case suitable for mounting on a panel and are an end product. Excludes all instruments for use on motor vehicles which are capable of accuracies of + or - 2% of full scale indication):					
38253 08	Digital panel meters (DPM) between 0.05% and 1%, + or - 1 digit accuracy (excluding precision DVM's and electronic counters).....	23	325,711	27,193	313,825	28,228
38253 10	Analog solid state panel meters (generally of + or - 2% accuracy) with LED, LCD, or neon gas discharge display.....	8	72,607	6,011	79,362	4,724
	Panel type other than ruggedized or sealed (generally of 2% accuracy):					
38253 12	A.c. (including moving iron vane and dynamometer types).....	13	499,728	11,031	528,590	12,007
38253 13	D.c. (including rectifier and self-contained thermocouple types).....	21	2,301,971	42,496	2,592,919	47,921
38253 11	Panel types ruggedized or sealed (generally of 2% accuracy).....	17	440,206	12,194	490,665	13,179

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985—Continued

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
	Electrical integrating instruments—Continued					
	Electrical indicating instruments (including both digital types and those where a pointer is made to move over a calibrated scale, such movement being effected by the action of the electrical current and/or voltage:—					
	Continued					
	Panel types with control or signal initiating means (including instrument relays):					
38253 16	Indicating.....	8	90,537	5,552	97,634	5,904
38253 17	Nonindicating.....	4	1,769	852	2,361	988
38253 19	All other panel type instruments, including ammeters and voltmeters for motor vehicles.....	14	7,838,219	38,189	8,583,965	41,817
	Switchboard instruments which are generally of 1% accuracy:					
38253 23	A.c. (including moving iron vane and dynamometer types).....	11	40,533	20,588	38,484	18,771
38253 25	D.c. (including rectifier and thermocouple types).....	8	46,736	7,357	47,332	7,414
38253 27	Elapsed time meters (with and without reset).....	12	865,327	20,896	714,384	13,578
	Portable instruments which are generally capable of accuracies within + or - 2% full scale indication, and can be enclosed in a case so that they can be moved and used at various locations, and which are an end product:					
38253 29	Portable types (accuracy rating 0.1% through 0.50%...)	6	3,703	3,068	3,708	2,693
38253 30	Portable type (accuracy rating 0.51% through 2%).....	10	21,707	2,105	21,180	1,912
38253 35	Laboratory portable instruments with accuracies within + or - 1% up to 1/10% of full scale and better (all case sizes).....	4				
38253 37	Volt-ohm millimeter (VOM), accuracy 0.10% through 5%..	3	161,205	15,867	293,314	15,369
38253 45	Other electrical indicating instruments (except self-balancing types).....	12				
	Electrical recording instruments (portable and for panel mounting):					
38253 50	Direct deflecting (direct acting), except temperature calibrated instruments.....	6	26,043	6,862	26,506	8,581
	Oscillographic recorders:					
38253 63	Pen or stylus type.....	10	178,519	175,639	177,870	174,486
38253 65	Light beam type.....	3				
38253 72	Other electrical recording instruments.....	18	(X)	120,104	(X)	98,948
	Parts and accessories for indicating and recording instruments:					
38253 74	Transducers for volts, amperes, watts, vars, frequency, temperature and power factor.....	19	(X)	51,184	(X)	52,960
38253 75	Tachometer generators except aerospace types.....	9	(X)	13,672	(X)	26,063
38253 76	Other including instrument shunts.....	18	(X)	25,505	(X)	27,431
38291	Aircraft engine instruments, except flight.....	41	(X)	504,737	(X)	393,074
38291 45	Temperature sensors, transmitters, and displays.....	20	(X)	86,542	(X)	80,621
38291 46	Pressure ratio sensors, displays, and controls.....	6	(X)	81,659	(X)	70,352
38291 47	Pressure and vacuum sensors, transmitters, and displays...	9				
38291 58	Fuel and oil flow rate sensors, transmitters, and displays, including mixture controls.....	9	(X)	45,601	(X)	37,374
38291 60	Fuel and oil quantity sensors, transmitters, and displays including densitometers.....	10	(X)	108,045	(X)	91,168
38291 62	Tachometer generators and indicators.....	10	(X)	17,121	(X)	9,727
38291 98	All other not specified above.....	17	(X)	163,000	(X)	101,259
38291 99	Parts and components for aircraft engine instruments, except flight (sold separately).....	5	(X)	2,769	(X)	2,533
38292	Physical properties testing and inspection equipment and kinematic testing and measuring equipment.	124	(X)	730,440	(X)	660,824
	Physical properties testing equipment including hardness, tensile, stress, strain, abrasion, strength, torsion, wear, and similar testing equipment (including components and parts sold separately):					
38292 32	For testing of metals.....	27	(X)	173,111	(X)	156,891
38292 34	Other.....	42	(X)	162,975	(X)	143,201
38292 39	Parts for physical properties testing equipment (sold separately).....	15	(X)	17,725	(X)	23,241
	Physical properties inspection equipment, including flow detection thickness, measuring, and similar inspection equipment (including components and parts sold separately):					
38292 32	For testing of metals.....	21	(X)	116,972	(X)	108,651
38292 34	Measuring and checking flow of fluids.....	8				
38292 56	Other.....	36	(X)	124,731	(X)	107,661
38292 58	Parts for physical properties inspection equipment (sold separately).....	13	(X)	9,795	(X)	6,376
	Kinematic testing and measuring equipment (including components and parts sold separately):					
38292 94	For testing of metals.....	6	(X)	13,513	(X)	11,534
38292 95	Other.....	21	(X)	109,542	(X)	99,411
38292 98	Parts for kinematic testing and measuring equipment (sold separately).....	7	(X)	2,076	(X)	1,648

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued

(Quantity in number of units; value in thousands of dollars)							Value
Product code	Product description	Number of companies	1986		1985		354,418
			Quantity	Value	Quantity	Value	
38293	Commercial meteorological, and general purpose instruments.....	101	(X)	319,331	(X)		
38293 20	Barometers and barographs, aneroid and mercurial types, including recorders, wall, pendant, meteorological, hygrothermographs, barometer-thermometer-humidity combinations.....	15	(X)	8,103	(X)		\$8,277
38293 21	Hydrometers, glass, all types, including thermohydrometers	10	300,311	2,571	282,247		2,543
38293 22	Liquid-in-glass thermometers: Engraved (etched) stem, thermoregulators, deep-sea reversing, laboratory, encased glass, ASTM standards, pocket case, max-min registering, except clinical thermometers.....	18	(X)	8,485	(X)		9,624
38293 23	Threaded and flanged types, fixed adjustable angle, conditioning, and refrigeration installations.....	14	538,873	7,957	534,823		7,779
38293 24	Household and commercial thermometers such as wall, outdoor, domestic science, cupcase, filled systems, indoor-outdoor.....	12	8,643,280	15,699	10,166,377		13,481
38293 34	Clinical (fever) thermometers (including digital).....	6	31,202,608	15,104	36,746,977		17,281
38293 25	Bimetal thermometers: Threaded and flanged types, for pipeline and duct installations, including general and pocket test.....	19	2,061,884	24,512	2,135,764		25,065
38293 26	Domestic science, commercial general test, indoor, outdoor, desk models, oven, refrigerator.....	14	6,469,496	13,133	6,132,502		11,999
38293 27	Humidity indicating and recording instruments such as bihygroscopic and hygroscopic element, indicators, psychrometers, wet and dry bulb, hygrometers, indicating hygrometers.....	9					18,855
38293 29	Other thermometers (infrared, meteorological, commercial and industrial).....	2	(X)	13,934	(X)		28,515
38293 31	Other meteorological instruments, including speed and direction instruments, rain gauges, thermographs, and parts (sold separately).....	20	(X)	30,239	(X)		84,234
38293 32	Geophysical instruments, including hydrographic and hydrological.....	9	(X)	54,861	(X)		126,755
38293 33	Other commercial and industrial instruments (except aircraft) including compasses, altimeters, test equipment for hydraulic and pneumatic systems and controls (sold separately).....	35	(X)	124,753	(X)		-
38293 39	Parts and accessories for meteorological and commercial and industrial instruments.....	-	-	-	-		542,157
38294	Nuclear radiation detection and monitoring instruments.....	58	(X)	560,649	(X)		35,742
38294 02	Radiation detecting elements (including ion chambers).....	9	73,661	36,805	51,011		16,857
38294 04	Solid state detectors.....	6	9,980	19,873	8,468		120,580
38294 06	Nuclear monitoring instruments (including environmental, personal dosimetry, and medical monitors, both stationary and portable types).....	18					35,989
38294 07	Medical and biological counting systems for in vivo counting.....	2	(X)	125,910	(X)		\$2,358
38294 09	Sample and flow counting systems, manual and automatic.....	9	(X)	33,080	(X)		\$5,186
38294 19	Scalers.....	4	1,493	4,182	1,362		20,429
38294 21	Special amplifiers for nuclear applications.....	4	6,827	4,157	6,566		
38294 22	Pulse analyzers (including nuclear spectrometers): Single channel pulse height analyzers.....	6			1,997		6,626
38294 23	Multichannel pulse height analyzers.....	6	3,480	33,847			128,101
38294 25	Count rate meters.....	6	4,246	4,605	5,442		\$12,425
38294 29	Measurement and control devices using beta, gamma, or neutron gauge technology.....	13	(X)	133,114	(X)		\$16,895
38294 28	Input-output accessories for multichannel analyzers.....	2	(X)	10,580	(X)		
38294 30	Nuclear power supplies.....	6					\$117,402
38294 32	Neutron and photon activation analysis systems.....	1	(X)	16,963	(X)		
38294 34	Nuclear instrument modules n.e.c.....	6					\$23,567
38294 39	Other nuclear radiation detection and monitoring instruments.....	12	(X)	109,776	(X)		2,716,041
38294 98	Parts and components for nuclear radiation detection and monitoring instruments (sold separately).....	7	(X)	27,757	(X)		
38326	Analytical and scientific instruments (except optical).....	163	(X)	2,724,303	(X)		\$29,315
38326 01	Electrochemical instruments: Ph electrodes and meters.....	15	(X)	27,032	(X)		\$18,902
38326 03	Ion selective electrodes and meters.....	9	(X)	18,489	(X)		40,668
38326 04	Electrophoresis instruments.....	9					137,624
38326 18	Specific ion measuring instruments, laboratory type.....	3	(X)	35,449	(X)		214,693
38326 07	Chromatographic instruments: Gas.....	14	52,563	149,511	44,393		
38326 15	Liquid.....	16					
38326 37	Other, including paper, gel, thin layer.....	3	39,891	241,085	37,833		

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
	Analytical and scientific instruments etc.--Continued					
38326 41	Spectrophotometric instruments:					
	Atomic absorption.....	5	6,559	70,186	7,278	70,982
38326 44	Optical emission, including spark, arc, and glow, spectrographs, all other, except ICP.....	4	141	10,991	139	11,385
38326 46	Optical emission, including laser excited source (including laser microprobe source emission, laser source Raman and laser microprobe source Raman spectrometers).....	3				
38326 47	Optical emission with inductively coupled plasma, ICP... 2		11,679	17,131	12,477	14,528
38326 13	Infrared (including Fourier transform methods).....	12	6,411	120,399	4,485	119,318
38326 14	Ultraviolet, visible and colorimeters.....	17	14,133	67,497	15,117	70,317
38326 15	Fluorescent instruments, including fluorometers (except chemicals).....	8	17,456	19,168	13,150	14,704
38326 16	Color measuring devices.....	9	17,509	54,850	17,920	51,238
38326 17	Other, including vacuum ultraviolet, Raman, light scattering reflectors, helium glow, and light measuring.....	8	(X)	15,266	(X)	10,145
38326 19	Thermal analysis instruments, including thermogravimetric analyzers (TGA), quantitative thermal analyzers (QTA) and differential thermal analyzers (DTA).....	10	(X)	72,706	(X)	94,703
38326 20	Nuclear magnetic resonance instruments, including electron paramagnetic spin types (EP).....	2				
38326 21	Microscopes, electron and proton, including scanning.....	4				
38326 53	Particle beam excitation instruments including electron microprobes, auger, energy ion spectrometers, secondary ion mass spectrometer (SIMS), ion microprobes.....	4	4,251	196,327	3,020	163,205
38326 55	Photon excitation analyzers, including x-ray fluorescence - simultaneous, x-ray fluorescence - sequential, x-ray fluorescence - diffraction, x-ray diffraction, and energy dispersive systems (EDS).....	5	292	26,546	364	33,448
38326 23	Mass spectroscopy instrumentation.....	11	(X)	155,682	(X)	152,741
	Clinical laboratory instrumentation (includes instruments used in the clinical laboratory for measuring, analyzing, and processing clinical specimens).....	(X)	(X)	610,143	(X)	631,876
38326 71	Chemistry (measure and identify substances, e.g. metabolites, enzymes, and drugs).....	10	10,237	257,380	10,547	334,014
38326 72	Hematology (measure and identify substances or cells contained in blood or substances influencing the development and clotting of blood, e.g., cell counting coagulation factors).....	9	8,392	154,751	5,962	106,683
38326 73	Microbiology (enumerate or identify pathogenic organisms or measure their susceptibility to anti-microbial agents).....	7	5,903	24,415	6,175	25,790
38326 74	Histology (process tissue and cells, e.g., tissue processors, cell stainers).....	1				
38326 75	Blood bank and immunology (process blood and specimens for testing; measure and identify, using immunoassay, substances in clinical specimens).....	9	9,148	77,329	7,901	57,738
38326 76	Other clinical laboratory instrumentation not specified above.....	13	10,148	96,268	9,800	107,661
38326 59	Elemental analysis instruments, including carbon, hydrogen, nitrogen, oxygen, and sulphur.....	12	51,605	102,789	128,130	116,660
38326 92	Amino acid, protein and/or peptide analyzers (including chromatographic type).....	1				
38326 94	Other analytical and scientific instruments n.e.c., including molecular weight, monochrometers (analytical type), nephelometers (except meteorological), osmometers, particle size analyzers, photo multipliers, surface area analyzers, turbidimeters, and breathalyzers.....	58	(X)	255,108	(X)	253,568
38326 98	Parts, components, and accessories for analytical and scientific instruments (sold separately), including photo tubes, thermal conductivity sensors, thermopiles, etc., which are not specifically provided for in product class 38325, optical instruments.....	62	(X)	458,208	(X)	466,021

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS: 1986 AND 1985--Continued

(Quantity in number of units; value in thousands of dollars)

Product code	Product description	Number of companies	1986		1985	
			Quantity	Value	Quantity	Value
38325	Optical instruments.....	122	(X)	1,239,238	(X)	1,345,794
38325 01	Binoculars, and astronomical instruments:					
	Binoculars, prismatic and nonprismatic, terrestrial and celestial telescopes.....	11				
38325 03	Other astronomical instruments (excluding radio astronomy).....	2				
38325 09	Parts and accessories (including mountings) for binoculars, optical telescopes and other astronomical equipment.....	2	(X)	23,198	(X)	32,226
	Other optical instruments:					
38325 12	Optical test and inspection equipment including standard sources modulators, optical comparators, interferometers (except optical microscopes).....	32	(X)	216,927	(X)	240,890
38325 15	Optical microscopes.....	7	(X)	50,503	(X)	49,805
	Optical components:					
38325 17	Filters and parts and accessories.....	17	(X)	40,739	(X)	36,942
	Lenses, except ophthalmic focus lenses:					
38325 21	Unmounted lenses.....	38	(X)	71,485	(X)	66,266
	Mounted lenses:					
38325 22	Photographic lenses.....	8	(X)	8,052	(X)	9,364
38325 23	Other mounted lenses.....	19	(X)	81,267	(X)	92,346
38325 29	Other (prisms, mirrors, etc.).....	39	(X)	86,900	(X)	84,984
38325 59	Other optical instruments (including optical alignment and display instruments) excluding analytical instruments and binoculars and astronomical instruments listed above and sighting and fire control equipment.....	33	(X)	591,330	(X)	674,428
38325 39	Parts and accessories for other microscopes.....	2				
38325 49	Parts and accessories for other optical instruments...	6	(X)	68,837	(X)	58,543
38324	Sighting, tracking, and fire-control equipment, optical type.....	40	(X)	566,947	(X)	556,304
38324 01	Made from lenses, prisms, etc., produced in the same plant	23	(X)	296,772	(X)	296,665
38324 02	Made from purchased lenses, prisms, etc.....	24				
38324 99	Parts and accessories.....	3	(X)	270,075	(X)	259,639

Note: Data for two or more product codes may be combined to avoid disclosing figures for individual companies.

The percent of estimation of each item is indicated as follows (see "Description of Survey" for a discussion of estimation of missing reports): ^a10 to 25 percent of this item has been estimated. ^b25 to 50 percent of this item has been estimated. ^cOver 50 percent of this item has been estimated.

* New for 1986. - Represents zero. (D) Data withheld to avoid disclosing figures for individual companies. N.e.c. Not elsewhere classified. [†]Revised by 5 percent or more from previously published figures. (X) Not applicable.

Table 3. COMPARISON OF VALUES OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS, AS REPORTED IN THE MA389, THE 1985 ANNUAL SURVEY OF MANUFACTURES, AND THE 1982 CENSUS OF MANUFACTURES

(Value in millions of dollars)

Product code	Product description	1985			1982	
		MA389	Annual Survey of Manufactures		MA389	Census of Manufactures
			Value	Standard error of estimates ¹		
3811	Engineering and scientific instruments.....	(X)	3,645.7	4	(X)	2,964.4
38111	Aeronautical, nautical, and navigational instruments.....	1,592.0	1,838.3	5	1,404.7	1,418.7
38112	Laboratory and scientific apparatus.....	1,138.1	1,308.8	7	1,028.1	1,083.6
38113	Surveying and drafting instruments and associated equipment.....	379.5	406.4	15	256.2	259.9
38110 00	Engineering and scientific instruments n.s.k., typically for establishments with 10 employees or more.....	(2)	92.2	39	(2)	128.2
38110 02	Engineering and scientific instruments n.s.k., typically for establishments with less than 10 employees.....					74.0
3822	Controls for monitoring residential and commercial environments and appliance regulating controls.....	(X)	2,046.1	3	(X)	1,544.5
38220 00	Controls for monitoring residential and commercial environments and appliance regulating controls, typically for establishments with 20 employees or more.....	1,925.6	2,046.1	3	1,439.4	1,512.3
38220 02	Controls for monitoring residential and commercial environments and appliance regulating controls n.s.k., typically for establishments with less than 20 employees.....					32.2
3823	Process control instruments.....	(X)	4,453.6	3	(X)	3,915.1
38230 00	Process control instruments, typically for establishments with 20 employees or more.....	3,263.2	4,453.6	3	3,750.8	3,814.2
38230 02	Process control instruments n.s.k., typically for establishments with less than 20 employees.....					100.9
3824	Fluid meters and counting devices.....	(X)	958.0	7	(X)	787.1
38242	Integrating and totalizing meters for gas and liquids.....	548.6	555.3	10	493.5	519.6
38243	Counting devices.....	174.9	182.1	8	166.8	162.0
38244	Motor vehicle instruments, except electric.....	(NA)	191.0	10	(2)	76.2
38240 00	Fluid meters and counting devices n.s.k., typically for establishments with 20 employees or more.....	(2)	29.7	14	(2)	11.8
38240 02	Fluid meters and counting devices n.s.k., typically for establishments with less than 20 employees.....					17.5
3825	Instruments to measure electricity.....	(X)	7,260.8	2	(X)	5,575.6
38251	Integrating instruments, electrical.....	402.6	426.6	1	339.0	383.2
38252	Test equipment for testing electrical, radio, and communication circuits and motors.....	5,698.9	5,962.3	2	4,384.6	4,455.2
38253	Other electrical measuring instruments.....	603.0	608.4	4	539.0	556.7
38250 00	Instruments to measure electricity n.s.k., typically for establishments with 10 employees or more.....	(2)	263.4	6	(2)	102.1
38250 02	Instruments to measure electricity n.s.k., typically for establishments with less than 10 employees.....					98.4
3829	Measuring and controlling devices n.e.c.....	(X)	2,252.8	4	(X)	2,073.4
38291	Aircraft engine instruments, except flight.....	393.1	428.3	7	290.3	311.0
38294	Physical properties and kinematic testing equipment.....	660.8	721.1	7	590.7	635.2
38293	Commercial, meteorological, and general purpose instruments.....	356.4	390.1	15	325.4	365.2
38294	Nuclear radiation detection and monitoring instruments.....	542.2	604.7	5	561.5	596.4
38290 00	Measuring and controlling devices n.e.c., n.s.k., typically for establishments with 5 employees or more.....	(2)	108.6	19	(2)	123.1
38290 02	Measuring and controlling devices n.e.c., n.s.k., typically for establishments with less than 5 employees.....					42.5
3832	Analytical and optical instruments.....	(X)	5,063.6	3	(X)	3,678.4
38326	Analytical and scientific instruments.....	2,716.0	2,941.2	5	1,990.3	2,088.4
38325	Optical instruments and lenses.....	1,345.8	1,401.8	5	893.7	922.8
38324	Sighting, tracking, and fire-control equipment, optical type.....	556.3	624.3	1	492.2	505.4
38320 00	Analytical and optical instruments n.s.k., typically for establishments with 10 employees or more.....	(2)	96.3	28	(2)	118.3
38320 02	Analytical and optical instruments n.s.k., typically for establishments with less than 10 employees.....					43.5
3494	Valves and pipe fittings.....	(NA)	9,006.5	2	(NA)	8,705.1
3494D	Aerospace type valves, pneumatic and hydraulic.....	255.5	297.0	13	208.9	262.2
3494A	Other metal valves for piping systems and equipment except plumbing and heating valves.....	(2)	2,764.4	4	(2)	3,425.5
3494B	Nuclear valves, except aerospace type.....	3,498.8	492.4	5	443.7	435.3
3494C	Pneumatic valves, except aerospace type.....	405.6	397.2	7	343.0	339.2
3494D	Nuclear valves.....	(2)	84.0	20	(2)	152.0
34944	Plumbing and heating valves and specialties excluding plumbers' brass goods.....	(2)	469.2	6	(2)	220.2
34945	Metal fittings, flanges, and unions for piping systems.....	(2)	1,800.1	5	(2)	1,491.2

See footnotes at end of table.

Table 3. COMPARISON OF VALUES OF SHIPMENTS OF SELECTED INSTRUMENTS AND RELATED PRODUCTS, AS REPORTED IN THE MA388, THE 1985 ANNUAL SURVEY OF MANUFACTURES, AND THE 1982 CENSUS OF MANUFACTURES--Continued

(Value in millions of dollars)

(value in millions of dollars)

Product code	Product description	1985			1982	
		MA38B	Annual Survey of Manufactures		MA38B	Census of Manufactures
			Value	Standard error of estimates ¹		
	Valves and pipe fittings--Continued					
34947	Automatic regulating and control valves.....	1,324.3	1,294.5	5	1,184.5	1,233.0
34948	Solenoid valves (except power transfer).....	280.1	303.6	7	201.5	206.1
3494E	Fittings for metal and plastics tubing used in fluid power transfer systems.....	3 384.2	427.6	6	3 295.0	302.7
3484F	Hydraulic and pneumatic hose or tube end fittings and assemblies, except aerospace type.....	3 439.8	349.6	4	3 329.0	319.7
3494G	Aerospace type hydraulic and pneumatic hose or tube end fittings and assemblies.....	3 154.8	193.9	22	3 117.3	119.0
3494H	Parts for fluid power valves.....	3 123.7	99.1	7	3 107.2	101.0
34940 00	Valves and pipe fittings n.s.k., typically for establishments with 20 employees or more.....					
34940 02	Valves and pipe fittings n.s.k., typically for establishments with less than 20 employees.....	(²)	253.8	8	(²)	128.9
						121.1

Note: In the 1982 Census of Manufactures, shipments data for establishments of small companies (typically those with fewer than five employees for industries 3811, 3822, 3823, 3824, 3825, 3829, and 3832, and fewer than 20 employees for industry 3494) were estimated from administrative records data rather than collected on census questionnaires. These shipments are included in product codes 38110 02, 38220 02, 38230 02, 38240 02, 38250 02, 38290 02, 38320 02, and 34940 02. Products not adequately identified by detail product were coded to the appropriate industry (four digits) followed by "000."

(NA) Not available. N.e.c. Not elsewhere classified. N.s.k. Not specified by kind. (X) Not applicable.

¹The annual survey of manufactures percentage standard errors shown are the approximate relative errors of the estimates of level. A more detailed description of the standard error of estimate is given in the introduction of the annual survey of manufactures, Value of Product Shipments, MS5(AS)-2, under "Qualifications of the Data."

²Detail data available only for the census of manufactures. A substantial portion of these data are derived from administrative records. See note above.

³Detailed product data for these product classes are published in Current Industrial Report Series, MA35N, Fluid Power Products, Including Aerospace.

Table 4. SELECTED INSTRUMENTS AND RELATED PRODUCTS--SHIPMENTS, EXPORTS, IMPORTS, AND APPARENT CONSUMPTION: 1986

(Value in thousands of dollars)

Product code ¹	Product description	Manufacturers' shipments ² (value f.o.b. plant)	Exports of domestic merchandise		Percent exports to manufacturers' shipments ⁴	Imports for consumption value in foreign country ⁵	Apparent consumption (value) ⁶	Percent imports to apparent consumption
			Value at port ^{1 2}	Estimated producers' shipments ³				
34947 --	Automatic valves (regulating and control type)...	1,325,773	7291,723	7235,508	18	(NA)	(NA)	(NA)
34948 --	Solenoid valves.....	281,129	7170,545	7137,681	49			
38111 --	Aeronautical, nautical, and navigational instruments, except aircraft engine instruments.....	1,931,913	7453,925	7384,293	20	7328,003	1,875,623	17
38112 --	Laboratory and scientific apparatus.....	1,126,357	7393,074	7332,776	30	199,801	993,382	20
38113 --	Surveying and drafting instruments and associated equipment and laboratory furniture.....	390,910	58,780	49,763	13	7138,867	480,014	29
38220 --	Controls for monitoring residential and commercial environments and appliance regulating controls.....	2,027,254	7346,907	7313,881	15	7545,994	5,451,298	10
38230 --	Process control instruments.....	3,891,019	7772,644	7699,088	18			
38242 --	Integrating meters, nonelectrical type.....	520,111	747,398	42,886	8	19,683	496,908	4
38243 --	Counting devices.....	175,205	725,103	22,713	13	42,201	194,693	22
38244 --	Motor vehicle instruments.....	203,583	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
38251 --	Integrating instruments, electrical.....	403,039	731,579	728,573	7	3,556	378,022	1
38252 --	Test equipment for testing electrical, radio, and communication circuits, and motors.....	5,270,344	71,657,530	71,499,733	28	71,096,640	5,418,126	20
38253 --	Instruments to measure electricity.....	606,367	761,331	755,492	9			
38291 --	Aircraft engine instruments, except flight.....	504,737	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
38292 --	Physical properties and kinematic testing and inspection equipment.....	730,440	146,966	132,977	18	21,729	619,192	4
38293 --	Commercial, meteorological, and general purpose instruments.....	319,331	408,165	369,308	(NA)	7174,745	124,768	(NA)
38294 --	Nuclear radiation detection and monitoring instruments.....	560,649	7193,335	7174,933	31	39,743	425,459	9
38326 --	Analytical and scientific instruments (except optical).....	2,724,583	942,709	836,843	31	7280,598	2,168,338	13
38325 --	Optical instruments.....	1,239,238	237,664	210,974	17	767,942	1,796,206	43
38324 --	Sighting, tracking, and fire-control equipment, optical type.....	566,947	207,899	184,552	33	333	382,728	(2)

(NA) Not available. (2) Less than one-half of 1 percent.

¹For comparison of SIC-based product codes, Schedule B export numbers, and TSUSA import numbers, see table 5.²Source: Bureau of the Census report, EM 346, U.S. Exports.

³These values were derived by use of adjustment factors to exclude freight, insurance, and other charges incurred in moving goods to the port of export. This adjustment is made to convert the values to an approximation of the producers' value of exported goods. Current adjustment factors are based on data for 1983 which are published in *Origin of Exports of Manufactured Products*, MB3(AS)-5, appendix B. The adjustment factor for products corresponding to industry group 349, miscellaneous-fabricated metal products, is 0.8073. The adjustment factor for products corresponding to industry group 381, engineering, scientific instruments, is 0.8466. The adjustment factor for products corresponding to industry group 382, measuring, controlling devices, is 0.9048. The adjustment factor for products corresponding to industry group 383, optical instruments and lenses, is 0.8877.

⁴These percentages are based on comparing estimated producers' export values with total domestic manufacturers' shipments values.

⁵Source: Bureau of the Census report, IM 146, U.S. Imports for Consumption.

⁶Apparent consumption is derived by subtracting the estimated producers' value of exports from the sum of manufacturers' shipments plus imports for consumption.

⁷Data include products which are extraneous to this product class. Therefore, the values may be overstated. See table 5 for those import and export numbers which contain extraneous products and have been included in two or more product classes.

⁸Several of the instruments in this product code are also collected in product code 36625 on Current Industrial Report Series, MA36P, *Communication Equipment, Including Telephone, Telegraph, and Other Electronic Systems and Equipment*.

Table 5. COMPARISON OF STANDARD INDUSTRIAL CLASSIFICATION-BASED CODES, SCHEDULE B EXPORT NUMBERS, AND TSUSA IMPORT NUMBERS: 1986

Product code	Product description	Export number	Import number	Product code	Product description	Export number	Import number
34947	Automatic valves (regulating and control type)	680.2741 680.2742 680.2743 *680.2749	(NA)	38242	Integrating meters, nonelectrical type	713.0130 713.0140 713.0160	*713.0500 *713.1100 713.1500
34948	Solenoid valves	680.2730 *680.2749	(NA)				
			710.0900 710.1400 710.1500 710.1600 710.1700 710.2000 710.2100 710.3000 710.4600	38243	Counting devices	711.9220 711.9225 711.9240	711.9000 711.9225 711.9840
38111	Aeronautical, nautical, and navigational instruments, except aircraft engine instruments	710.1020 710.1050 710.1070 711.9228	710.4700 711.3300 711.3900 711.7100 711.7300 711.8100 712.0000 712.0600 712.1000 712.1200 712.4700 712.4800 712.5200	38251	Integrating instruments, electrical	713.0110 713.0150	713.0700 713.0900
				38252	Test equipment for testing electrical, radio, and communication circuits, and motors	*712.5005 712.5020 712.5025 712.5032 712.5035 712.5040 712.5045 712.5052 712.5055	(A)
38112	Laboratory scientific apparatus	661.3020 661.3030 661.3046 661.3050 661.7015 661.7620 661.7640 683.4523 683.4540 711.0100	*661.3000 *661.9000 *683.8520 711.0800 712.4920	38253	Instruments to measure electricity	*686.1030 *686.1035	*686.1030 *686.1035 *712.4971 *712.4975 *713.1700 *713.1900
			710.0400 710.1200 *710.4000 *710.4200 *710.5000 710.6000 710.6100 710.6300 710.6700 710.6800 710.7000 710.7200 710.8023 712.4910	38291	Aircraft engine instruments, except flight	(NA)	(NA)
38113	Surveying and drafting instruments an associated equipment and laboratory furniture	710.3420 710.3840		38292	Physical properties and kinematic testing and inspection equipment	711.2420 711.2440	711.2500 712.4930
38220	Controls for monitoring residential and commercial environments and appliances regulating controls	711.8002 711.8010 711.8018 711.8026 711.8042 711.8050 711.8058 711.8080 711.8090	(3)				*710.0800 710.2600 710.2700 710.3400 710.3600 *710.4000 *710.4200 *710.5000 711.3000 711.3100 711.3200 711.3800 711.4000 711.4200 711.4300 711.4700 711.4900 711.5500 711.6000 711.6700 712.2000 712.2500 712.2700 *712.4910 712.4961
38230	Process control instruments	*686.1030 *686.1035 711.8006 711.8014 711.8022 711.8030 711.8034 711.8046 711.8054 711.8062 711.8066 711.8070 711.8075	*711.7000 *711.7200 *711.7620 *711.7840 *712.4950 *712.4955	38293	Commercial, meteorological, and general purpose instruments	710.1820 710.1840 710.2820 710.2840 711.3320 711.3340	

See footnotes at end of table.

Table 5. COMPARISON OF STANDARD INDUSTRIAL CLASSIFICATION-BASED CODES, SCHEDULE B EXPORT NUMBERS, AND TSUSA IMPORT NUMBERS: 1986--Continued

Product code	Product description	Export number ¹	Import number ²	Product code	Product description	Export number ¹	Import number ²
38294	Nuclear radiation detection and monitoring instruments	709.6640 709.6660 712.1520 712.1560	709.6640 709.6660 712.1510 712.1560				
		708.7800 711.8710 711.8722 711.8724 711.8726 711.8728 711.8729 711.8732 711.8734 711.8736 711.8738 711.8741 711.8743 711.8745 711.8746 711.8747 711.8749 711.8750 711.8760		38325	Optical instruments	708.0600 708.2220 708.2240 708.2280 708.5410 708.5420 708.5440 708.5450 708.7400 708.9400 710.8900	
38326	Analytical and scientific instruments (except optical)		708.7800 711.8800 712.4960				
				38324	Sighting, tracking, and fire-control equipment, optical type	708.5430 708.9200	

¹Part of this code is comparable. (NA) Not available.

²Source: 1986 edition Schedule B, Statistical Classification of Domestic and Foreign Commodities Exported from the United States.

³Source: Tariff Schedules of the United States Annotated (TSUSA), 1986.

⁴Imports for product code 38220 are included in product code 38230.

⁵Imports for product code 38252 are included in product code 38253.

DESCRIPTION OF SURVEY

Scope of Survey. This survey covers firms engaged in the manufacture of instruments and related products, except very small firms (generally less than 20 employees) for which 1982 Census of Manufactures data were derived from administrative records of other government agencies.

Survey Methodology. The statistics in this publication were collected by mail on Bureau of the Census annual Form MA38B, Selected Instruments and Related Products. The survey panel includes all known producers of these products, except the very small firms excluded from the scope of the survey. Approximately 1,500 companies are included. No estimate is derived for the small firms excluded from the survey.

Reliability of Data. Survey error may result from several sources: (1) inability to obtain information about all cases in the survey; (2) response errors; (3) definitional difficulties; (4) differences in the interpretation of questions; (5) mistakes in recording or coding the data obtained; and (6) other errors of collection, response, coverage, and estimation for missing data. These non-sampling errors also occur in complete censuses. Although no direct measurement of the biases due to nonsampling errors has been obtained, precautionary steps were taken in all phases of the collection, processing, and tabulation of the data in an effort to minimize their influence.

A major source of bias in the published estimates is due to imputing data for nonrespondents, for late reporters, and for data which fail logic edits. Missing figures are imputed based on yearly movements shown by reporting firms. Imputation generally is limited to a maximum of 10 percent for any one data cell. Figures with imputation rates greater than 10 percent are footnoted.

The imputation rate is not an explicit indicator of the potential error in published figures due to nonresponse, because the actual yearly movements for nonrespondents may or may not closely agree with the imputed movements. The range of difference between the actual and imputed figures is not precisely known, but is assumed to be small. The degree of uncertainty regarding the accuracy of the published data, however, increases as the percentage of imputation increases. Figures with imputation rates above 10 percent should be used with caution.

Revisions to Previous Period Data. Statistics for previous years may be revised as the result of corrected data from respondents, late reports for which imputations were made as described above, or other corrections. Figures which have been revised by more than 5 percent from previously published figures are indicated by footnotes.

Revisions include changes to prior period data resulting from reconciliation of the results of this survey with the 1985 Annual Survey of Manufactures to correct differences in reported data between the two series and to identify and verify new establishments included in the scope of this survey. Table 3 presents a comparison of data from the two series by census product class following the reconciliation.

Adjustment for Price Change. All dollar figures included in this publication are in current dollars; i.e., they have not been adjusted for price change.

EXPLANATION OF TERMS

Quantity and Value of Shipments. The figures on quantity and value of shipments represent physical shipments of all products sold, transferred to other establishments of the same company, or shipped on consignment, whether for domestic or export sale. The value represents the net sales price, f.o.b. plant, to the customer or branch to which the products are shipped, net of discounts, allowances, freight charges, and returns. Shipments to a company's own branches are assigned the same value as comparable sales to unaffiliated customers; i.e., the value includes an appropriate allocation of company overhead and profit. Products bought and resold without further manufacture are excluded.

Electronic Systems—Unified Architecture. Includes system-type control, display and computing instruments actuated from standardized electrical transmission signals in which control and signal conditioning are integral with the display/operator interface.

Electronic Systems—Non-Unified Architecture. Includes system-type instruments and related equipment actuated from standardized electrical transmission signals in which control and signal conditioning are separated from the display/operator interface. Equipment includes single loop and multi-loop controllers, dedicated operator stations, shared CRT-based operator work stations, process I/O equipment, communication equipment and other related miscellaneous equipment such as power supplies, racks, panels, cables, console furniture, printers, tape drivers, mounting hardware, shelves, nests calibrators, testors, etc. Does not include multi-function process computers reported in 3823012.

Industrial Multi-Function Process Computers. Includes the hardware and standard software of the CPU and all peripheral equipment of the computers that provide centralized processing intelligence for two or more of the following functions: data manipulation and reporting, supervisory control and data acquisition, calculations using control algorithms, data base management, use of a high-level programming language and operator interface.

COMPARISON OF EXPORT, IMPORT, AND DOMESTIC OUTPUT DATA

The Standard Industrial Classification (SIC) system used for domestic output and the statistical export and import commodity classifications were developed independently. This results in considerable difficulty in comparing the three types of data for many commodity areas. The domestic output classification is based on type of industry; on the other hand, the export and import

classification system is more materials oriented. Also, there are a substantial number of imported commodities which have no comparable domestic output classification. The relationships shown in this report should be considered only as approximations, since, in addition to the problems mentioned above, there are also the following problems affecting the comparability of the three sets of data.

Valuation. There are different methods of valuation for the three types of data:

- **Domestic Output**—Valued at the point of production. It includes the net sales price, f.o.b. plant, after discounts and allowances, exclusive of freight charges and excise taxes.
- **Exports**—Valued at the point of exportation. It includes the selling price, or cost if not sold, and inland freight, insurance and other charges to the export point.
Estimated producers' values of exports have also been developed. These values more closely approximate the values reported for domestic output because they exclude freight, insurance, and other charges applied from the producing plant to the export point.
- **Imports**—Valued at the first port of entry in the United States. It includes c.i.f. (cost, insurance, and freight), duty, and other charges to the import point.

Duplication in Quantity and Value of Output. Because producers' shipments of some commodities may be used as materials for incorporation into other commodities, combinations of data for such commodities may contain a certain amount of duplication. Thus, percentages of exports to output or imports to apparent consumption (output plus imports minus exports) at four-digit or broader levels may be understated. Where duplication is known to be substantial, the output data are appropriately noted in the table.

Low-Value Import and Export Transactions. Detailed commodity information is not included for individual export shipments valued at not more than \$1,000. Generally, detailed commodity information is not included for individual import shipments valued at not more than \$1,000. For textiles and textile products, gloves, footwear, and miscellaneous rubber and plastics products, detailed commodity information is not included for individual import shipments valued at not more than \$250. This is believed to have only negligible effects on the statistics for the bulk of the commodities.

Manufacturers' Shipments, Not Specified by Kind. The value of manufacturers' shipments at the four-digit industry level often includes a small amount which is not distributed among the individual five-digit product classes. Export and import percentages at the more detailed levels might, therefore, be slightly overstated.

Time Lag Between Output and Exports. There will be a lag between the time a commodity is produced or shipped by the

producer and the time it is actually exported, especially when intermediaries (wholesalers, exporters, etc.) are involved. Ordinarily, this type of discrepancy is insignificant in annual figures.

"Direct" vs "Total" Commodity Exports and Imports. Export and import data do not include materials which are incorporated into other more finished products and exported or imported in finished form. Thus, by showing only direct exports and imports, the relation of exports to output and imports to apparent consumption for intermediate products is considerably understated.

Used Commodities. With a few exceptions, used or rebuilt commodities are classified in the same import or export codes as is new merchandise. Percentages are thus overstated to the extent that used or rebuilt products are significant in trade.

Geographic Area of Coverage. Import and export data reflect the movement of merchandise into and out of U.S. foreign trade zones, the U.S. Virgin Islands, and the U.S. customs territory (includes the 50 States, the District of Columbia, and Puerto Rico).

HISTORICAL NOTE

Data on selected instruments and related products have been collected by the Bureau of the Census since 1961. Historical data may be obtained from Current Industrial Reports available at your local Federal Depository Library. A list of these libraries may be obtained from the Bureau of the Census regional offices:

Office	Telephone
Atlanta, Georgia	(404) 347-2271
Boston, Massachusetts	(617) 223-2327
Charlotte, North Carolina	(704) 371-6142
Chicago, Illinois	(312) 353-6251
Dallas, Texas	(214) 767-0621
Denver, Colorado	(303) 236-2200
Detroit, Michigan	(313) 226-7742
Kansas City, Kansas	(816) 374-4601
Los Angeles, California	(213) 209-6616
New York, New York	(212) 264-3860
Philadelphia, Pennsylvania	(215) 597-4920
Seattle, Washington	(206) 442-7828

Historical data are also available on microfiche. For further information contact the Bureau of the Census, Data User Services Division, (301) 763-4100.

RELATED REPORTS

The Bureau of the Census publishes the following related reports:

Series	Frequency	Title
<i>Current Industrial Reports</i>		
MA36A	Annually	<i>Switchgear, Switchboard Apparatus, Relays, and Industrial Controls</i>

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Official Business
Penalty for Private Use, \$300

FIRST-CLASS MAIL
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CENSUS
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Series	Frequency	Title
MA36F	Annually	<i>Major Household Appliances</i>
MA36P	Annually	<i>Communication Equipment, Including Telephone, Telegraph, and Other Electronic Systems and Equipment</i>
MA36Q	Annually	<i>Semiconductors, Printed Circuit Boards, and Other Electronic Components</i>
MA36R	Annually	<i>Electromedical Equipment and Irradiation Equipment (Including X-ray)</i>

Industry Reports

M3-1	Monthly	<i>Manufacturers' Shipments, Inventories, and Orders</i>
(AS)	Annually	<i>Annual Survey of Manufacturers (ASM)</i>
(MC)	Quinquennially	<i>Census of Manufactures</i>

Foreign Trade Reports

EM 546	Monthly	<i>U.S. Exports—Schedule B—</i>
FT 446	Annually	<i>Commodity by Country</i>
IM 146	Monthly	<i>U.S. Imports for</i>
FT 246	Annually	<i>Consumption—TSUSA—Commodity by Country</i>

CONTACTS FOR USERS

Subject Area	Contact	Phone Number
Current Industrial Report MA38B	Deborah Dillon	(301) 763-5194
Manufacturers' Shipments, Inventories, and Orders	Ruth Runyan	(301) 763-2520
Classification Systems Comparability	James Kristoff (ESD)	(301) 763-1935
Foreign Trade	Trade Data Inquiries Staff (FTD)	(301) 763-5140
Census/ASM	Tom Lee	(301) 763-5752
To order a Census Bureau publication	Customer Services (DUSD)	(301) 763-4100
International Trade Administration	Margaret Donnelly	(202) 377-5466

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